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Policy measures to promote the widespread utilization of renewable energy technologies for electricity generation in the Maldives

Klaas van Alphen[a,*], Huden S. Kunz[b], Marko P. Hekkert[a]

[a]*Department of Innovation Studies, Copernicus Institute for Sustainable Development and Innovation, Utrecht University, P.O. Box 80115, NL 3508 TC, Utrecht, The Netherlands*

[b]*Department of Environmental Science and Technology, Centre for Energy Policy and Technology, Imperial College London, Prince Consort Road, London SW7 2BP, UK*

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Abstract

This study adopts a stakeholder-based approach to understand the size and nature of the market and financial barriers to the widespread utilization of renewable energy technologies (RETs) in the Maldives. In light of these barriers and the interests of relevant stakeholders, this study evaluates different policy options in terms of their suitability to develop a domestic market for RETs in the Maldives. Evaluating the different policy instruments, it was found that pricing laws that regulate market access are more suitable than quota systems, provided that the current subsidies for conventional energy are removed or shifted towards RETs. As for the other financial incentives, rebates on investments and low-interest loans should be provided to RET project developers to overcome the high initial project costs. In addition to these measures, the limited institutional capacity suggests that policy support should also focus on enabling the steady development of regional institutions rather than on supporting individual RET projects. These institutions should enable islands in each atoll to take advantage of efficient management and access to financial capital. This will allow the development of sustained renewable energy projects that, in turn, will result in increased renewable capacity and decreased costs.

Keywords: Renewable energy; Market barriers; Stakeholder analysis; Policy evaluation; SIDS

*Corresponding author. Tel.: +31 30 2536369; fax: +31 30 2532746.
E-mail address: k.vanalphen@geo.uu.nl (K. van Alphen).

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1. Introduction

The small size of its islands and their low height above sea level deem the Maldives one of the most vulnerable countries to the projected impacts of climate change [1]. Like other small island developing states (SIDS), the Maldives depend overwhelmingly on petroleum import for its electricity production. Besides the clear ecological risks, this problem of energy security also creates serious economic and financial difficulties [2–4]. With respect to the rapidly growing energy demand in the Maldives—i.e., an annual growth of approximately 11% in the last decade [5], it is often argued that this republic should free itself from its heavy dependence on fossil fuels and move towards a more sustainable society that meets its energy requirements by application of renewable energy technologies (RETs) [5,6]. In van Alphen et al. [7], we showed that solar and wind diesel hybrid systems for electricity generation are financially feasible and could supplant a substantial amount of the fossil fuel-based generators on the outer islands and the capital city Malé.[1] Several studies confirm these results [9,10] and mention the potential of other RETs, such as bio-digesters and solar water heaters.

However, it is not certain that these economically viable RETs will indeed be implemented and utilized, since this is greatly influenced by various social, institutional, and political factors, i.e., the local Innovation System [11,12]. These factors constitute various non-technical barriers that impede the diffusion of RETs [13,14]. In order to overcome these barriers, the government of the Maldives has been actively pursuing

[1]The Maldives comprises 1192 small coral islands, of which 199 are inhabited. The Maldives are located southeast of India in the Indian Ocean. The total population is approximately 280,000 [8]. A quarter of the population resides in the capital Malé, located in the center of the republic where most of the commercial activities take place. Note that all the islands, except Malé and the resort islands, are considered ‘outer islands’.

several interrelated initiatives. In van Alphen et al. [15], we have evaluated these initiatives[2] by analyzing whether or not they strengthen the local Innovation System. This evaluation shows that the renewable energy programs initiated in the Maldives target most of the key processes in an Innovation System conducive to technology transfer. However, as not enough attention is being paid to local entrepreneurial activities and the creation of a domestic market for RETs, the process of RET transfer might run the risk of stagnation when the renewable energy programs end. Therefore, policy measures that can address the current imperfections and distortions in the market need to be taken into account.

The key challenge for such a policy framework is to facilitate a continuous market expansion and to ensure that cost reductions are carried through [17]. In spite of the surplus of literature on different policy support measures adopted in landlocked developing countries, there is a lack of studies assessing the suitability of these policy measures for SIDS [18]. It is not correct to assume that these policies can be directly transferred to SIDS, mainly because SIDS have a combination of economic, social, geographic, and climatic characteristics generating specific barriers that often differ considerably from those faced by other countries [19,20]. Therefore, a different approach to planning and policy formulation is required.

The absence of research in this field probably derives from the fact that, to date, only a few SIDS governments have developed policies to promote the use of RETs [21,22]. The Maldives have no national energy policy, let alone specific policies for the utilization of renewable energy [5]. However, the government of the Maldives realizes the importance of a long-term energy policy to support its plans to develop a domestic renewable energy market. The aim of this study is to propose a framework of policy measures that fosters such a viable market for RETs in the Maldives. The outcome of this analysis is not only of specific use for policy decisions regarding renewable energy development in the Maldives, but it can also be a valuable input for energy policy making in other SIDS.

2. Research methods and structure

The methodology adopted in this study involves literature surveys, reviews of national studies and reports, site visits, and interactions with energy sector stakeholders [17]; including policy makers, regulators, financiers, supply-side stakeholders, and demand-side stakeholders (Table 1). These interactions through structured interviews and questionnaires were used to provide a deeper insight into the size and nature—or 'dimensions'—of the most pressing market barriers within the energy sector that are impeding the diffusion of RETs (Section 3). Next, a literature review was carried out of the different policy measures that could be used to remove these barriers (Section 4). The results were shown in a concise report [23], in which a detailed assessment of the most persistent barriers was presented, along with a description of the different policy options that could be adopted to address these barriers. This report was discussed with the stakeholders

[2] i.e., the Renewable Energy Technology Development and Application Project (RETDAP) funded by the Global Environment Facility (GEF) under the United Nations Development Programme (UNDP) [5] and the Strengthening Maldivian Initiatives for a Long-term Energy Strategy (SMILES project) co-funded by the European Commission (EC) under the Asia Pro Eco Programme [16].

Table 1
Major energy sector stakeholders subdivided by: organizations involved in energy supply; agencies responsible for areas that create energy demand; agencies who facilitate financing for the energy sector; organization mandated for developing energy policy; and intermediaries (NGOs)

	Stakeholder	Role within the electricity sector
Supply side	State Trade Organization	This organization is the main importer of fossil fuels and electrical equipment (e.g. diesel generators and RET components).
	State Electric Company Island Development Committees Private operators	These are the major electricity providers in the Maldives, respectively owning 35%, 17%, and 48% of the country's installed capacity.
Demand side	Ministry of Tourism	This ministry is responsible for the resort islands, where nearly half of the country's generated electricity is consumed.
	Maldives Association of Construction Industry	This association represents organizations responsible for the construction of energy-intensive high-rise buildings.
	Maldives National Chamber of Commerce and Industry	This agency is responsible for various sectors creating the electricity demand.
Regulators/ policy makers	Maldives Electricity Bureau	This bureau is responsible for regulating the electricity sector.
	Ministry of Trade and Industries	The State Electric Company, the Maldives Electric Bureau, and the State Trade Organization are affiliated to this ministry.
	Ministry of Communications, Science, and Technology	This ministry is mandated with developing energy policy, including the promotion and implementation of RETs.
	Ministry of Home Affairs, Housing, and Environment	This ministry is mandated to regulate activities affecting the (conservation of the) environment.
Financiers	Ministry of Atolls Development	With the financial assistance of this ministry, the Island Development Committees provide electricity to 167 outer islands.
	Ministry of Finance and Treasury Bank of Maldives Maldives Finance Lease Company	This ministry finances (fossil fuel based) energy projects, either by itself or through affiliated organizations, i.e. the Maldives Finance Leasing Company or the Bank of Maldives.
NGOs	United Nations Development Program Republic of Maldives	The initiatives in the area of renewable energy development in the Maldives are mostly coordinated by NGOs.

during various meetings, in which the proposed policy measures were evaluated, taking into account the interests and requirements of the important stakeholder groups (Section 5) [24]. Finally, this evaluation allowed us to advice on which policies are most suitable to utilize the renewable resources in the Maldives and to develop a market for RETs (Section 6).

3. Understanding the size and nature of barriers

Market barriers are factors explaining why technologies, which appear to be cost effective, are not accepted by the market. Unequal tax burdens, existing subsidies on conventional energy technologies, high investment requirements, and the failure

to internalize environmental externalities can be considered as reasons why markets fail [25].

The stakeholder interviews revealed that both the State Electric Company and the Island Development Committees—together responsible for more than half of the electricity supply in the country[3]—receive extensive government support in the form of direct or indirect subsidies. The Ministry of Finance and Treasury provides soft loans to the State Electric Company for all outer island projects. Similarly, the Ministry of Atoll Development provides subsidies to the Island Development Committees in the form of grants, special loan schemes, and generator gifts for the provision of electricity [27]. Besides local funds, the Asian Development Bank and the World Bank financially support outer islands electrification projects based on conventional fuel technologies [9].

Furthermore, false competition is created by unequal tax burdens. While electricity suppliers receive 50% duty free concession on the import of generators, there is a 25% import duty to be paid on all RET components. This implies that negative externalities, such as environmental damage from conventional energy sources, are not considered in taxes, nor in energy pricing. No study appears to have assessed the implications of energy pricing on the social costs of energy consumption. At present, the pricing structure seems to be based merely on the supply costs [28]. The goal of charging equal rates throughout the country has resulted in a cross subsidy of the islands by Malé and other urban locations.

However, despite this cross subsidy, the outer island communities are still paying higher electricity rates compared to Malé.[4] It is a common view among the demand-side stakeholders that the operations of the major power suppliers in the Maldives lack transparency: ('they should make transparent what they charge customers').

As far as electricity pricing is concerned, the Maldives Electricity Bureau is supposed to look into this aspect and arbitrate. However, as both the Maldives Electricity Bureau and the State Electric Company operate under one roof (the Ministry of Trade and Industry), conflicts of interest may arise where electricity tariff setting is concerned, or where the provision of operation licenses becomes an issue [28]. At present, all power providers must be licensed by the Maldives Electricity Bureau. The licenses granted to Island Development Committees and private operators are temporary licenses with unwieldy conditions attached. This situation provides a loophole, as the Electricity Bureau can revoke the license of the Island Developing Committees and private operators at any time if the State Electric Company is interested in operating on their Island.

Apart from the absence of a competitive and open market for RETs, the difficulty in obtaining loans for renewable energy projects together with high investment requirements have resulted in the absence of entrepreneurs interested in engaging in this business [5]. Neither the Bank of Maldives nor the Maldives Finance Lease Company are eager to provide loans for RET projects. Both are concerned about the second-hand salability of assets, should repayments fail. Furthermore, the Bank of Maldives is reluctant to finance projects proposed by private parties. It considers these projects unreliable and 'high risk'. The Ministry of Treasure and Finance and the Ministry of Atoll Development do not offer

[3]The other half of the country's generation capacity of approximately 125 MW is installed on resort islands, owned by private operators [26]. Over the past 12 years, 89 islands were developed into resorts.

[4]Current prices differ from US$ 0.14/kW h for residential use to US$ 0.29/kW h for larger consumers in Malé and the larger inhabited islands. On the outer islands, the prices are roughly twice as high [28,29].

funding to private parties either. So, only the Island Development Committees and the State Electric Company would benefit from their financing schemes. Furthermore, the Ministries do not have a policy to support RETs, as they are not yet convinced that renewable energy is a reliable power source. Moreover, the long payback period of RETs does not correspond with the current repayment conditions of the ministries, i.e. a 5-year repayment period, at an interest rate of 8%.

4. Review of policy measures

Literature shows that policy measures for the removal of market barriers and the promotion of RETs have been explored in several studies, e.g., GEF experience in supporting RET projects in different countries can be found in Martinot et al. [30–32] and measures taken by IEA countries have been discussed in IEA [33,34]. Generally, a mix of instruments is essential and the key to success [35]. To limit the vast number of policy options considered in these and other studies, this study focuses on four main categories of relevant policy measures [12]: (1) regulations governing market access, (2) financial assistance and incentives, (3) addressing subsidies for conventional energy, and (4) public–private partnership and stakeholder involvement. There is not necessarily a direct link between these policy instruments and the above-mentioned specific barriers to RET utilization in the Maldives, as some of the policy measures target a combination of barriers.

4.1. Regulations governing market access

Since RETs are not able to compete in the existing energy market, energy suppliers may need to be required by law to include renewables in their supply mix. Two main types of regulatory policies have been used to open the grid to renewables: *pricing systems* and *quotas systems* [36]. The former guarantees price, whereas the latter ensures market share of renewable energy through government-mandated targets or quotas [37]. There are two major kinds of quota systems presently used for renewable electricity generation: tendering systems (e.g. Non-Fossil Fuel Obligations[5]) and obligation certificates (e.g. Renewables Portfolio Standards[6]).

With Non-Fossil Fuel Obligations, the government specifies the share of capacity to be achieved from each resource, plus the growth rates required over time. Subsequently, renewable energy developers submit price bids for contracts to sell electricity to utilities for a fixed term at a fixed premium price, which emerges from the competitive bidding process. Additional costs for the electricity utilities, obligated to purchase a certain amount of the renewable electricity from the winning producer, are reimbursed by a small charge for all electricity consumers [41].

Under Renewable Portfolio Standards, a political target is established for the minimum capacity or generation to be derived from renewables, requiring each supplier to provide a

[5]Most experience with the Non-Fossil Fuel Obligations process exists in the UK. A similar approach is the bidding for the California Energy Commission (New Technologies Account Auction) as well as the wind power bidding process in France and Austria [38,39].

[6]Renewable Portfolio Standards have been adopted in different countries around the world including North America, Japan, the UK, Italy, and Australia [35,40].

specified percentage of renewable energy in its electricity supply portfolio. The obligations can be made tradable through renewable energy credits [42]. Hence, it is for the investors and suppliers to determine how to comply with these targets, as it allows flexibility to generate renewable electricity or to purchase the equivalent certificates from other parties. Once the system has been established, government involvement includes the certifying of credits, as well as compliance monitoring and enforcement [43].

With quota systems, the government sets a target and lets the market determine the price. Pricing laws work in reverse, by letting a set price determine the share of renewables in the energy supply mix. Under a pricing system, power producers are paid a fixed price depending on the type of RET that is used to generate electricity. These prices are generally higher than the regular market price, and payments are usually guaranteed over a specified period of time, often with declining tariffs to reflect expected cost reductions [44]. The costs can be financed through a levy on electricity for all consumers. Experience in Europe with feed-in tariffs shows that this policy instrument has resulted in a substantial increase in capacity of renewable energy-based power systems [45–47]. A variation on this mechanism is net metering [48], in which distributed electricity generation (small renewable systems installed in homes or businesses) can be used to meet the private demand and in which surplus electricity can be fed back into the grid, allowing the meter to run backwards.

4.2. The provision of financial incentives

Financial incentives provide the cost reductions RETs require to compete with conventional energy technologies and to gain foothold in the energy market. These incentives either target capital investment in the technology or the quantity of renewable electricity supplied [49]. Incentives may include compensation in the form of tax credits, soft loans, rebates, and production payments [13]. Production payments reward electricity suppliers for generated energy by providing a subsidy payment per unit of electricity supplied. These subsidies reduce the risk of investing in RETs by increasing the return and reducing the payback period, provided that the payments are high enough to cover the possible additional costs of renewable electricity generation and that they are guaranteed over a sufficient time period. This policy integrates several key elements of a pricing law, similar in effect and perhaps more politically feasible in some countries [50].

However, the cost problems associated with RETs often stem from the capital costs of acquiring the RET rather than from the operating costs. Hence, financial assistance in the form of low-interest and long-term loans can play an important role in overcoming the barrier of high initial capital costs, by converting these costs into affordable operating costs [25]. Another policy instrument that targets the high capital investment in RETs are the so-called rebates, which either provide a specific share of the technology investment costs or refund a certain amount of money per unit of installed capacity.

The use of tax related incentives to promote a RET market is limited in a tax-free economy such as the Maldives, as investment and production tax credits would not apply. An application of tax incentives for the Maldives would be confined to the reduction or elimination of import duties on RET equipment and the introduction of a carbon tax on fossil fuel-based electricity production in order to internalize its negative externalities [51].

4.3. Addressing subsidies for conventional energy

The assessment of market barriers showed that conventional energy technologies benefit from hidden or indirect subsidies, which are often less apparent to policy makers. This is mainly due to the long history of permanent subsidies that have become innate in the country's energy sector. To ensure that competitors play on a level field, governments should weaken or even eliminate inappropriate, inconsistent, and inadequate policies that favor conventional technologies or fail to recognize the social, environmental, and economic advantages of renewable energy [52]. The use of cross-subsidies for outer island electrification in the Maldives may be an exception. Nevertheless, the lack of transparency of electricity pricing causes considerable suspicion among customers from whom the financing of these subsidies is obtained.

Shifting subsidies from conventional towards renewable energy will ensure that energy prices reflect both social and environmental costs as well as short-term production costs. However, it should be noted that full cost pricing is often difficult to achieve due to uncertainties about external costs and the resulting socio-political problems.

4.4. Public–private partnerships and stakeholder involvement

With a strong and increasing reliance on the private sector to finance investments in RETs and other infrastructure, public–private partnerships are gaining increasing importance. The basic justification for establishing partnerships is that the public and private sector have unique characteristics, providing them with advantages in specific aspects of service or project delivery [13]. Through co-operatives, people share both the risks and benefits of renewable projects. When technologies are forced upon a community without consultation regarding the people's needs or desires, or when these technologies are donated as part of an aid package, people often attach little value to them and do not feel called to maintain them. In fact, the key to success of some projects in other developing countries has been a sense of ownership among the local people, created by their involvement in the early stages of such projects [35]. Furthermore, local investments provide an opportunity to strengthen local economies, which may lead to new projects by sharing information and experience.

5. Evaluation of policy measures

The different policy options reviewed above were evaluated in collaboration with stakeholders. The evaluation, as deduced from the interviews, is specified later. Only few specifications to particular stakeholder groups are made, because of a broad consensus among the stakeholders when evaluating the different policy measures.

5.1. Quota systems

Stakeholders agreed that, when promoting RETs, regulations that govern market access would be effective, yet the feasibility of obligation certificates in the Maldives in terms of 'who is to regulate' and 'the difficulty in setting up the system' were noted. Besides the requirement to establish targets and timetables,[7] policy makers would need to set penalties

[7]When stakeholders were questioned what percentage of the total electricity demand through RE could be met by 2010, all agreed that setting a target above 5% was unrealistic. In fact, the majority (including policy makers)

for non-compliance, and tradability of credits should be assured. Clearly, with Renewable Portfolio Standards, the institutional limitations of the country become particularly relevant and although these standards might be more suitable in the longer term, when renewables become more established and the playing field is leveled, for the time being they appear overly complex and difficult to administer. Especially when considering that the Maldives, like most SIDS [53], have understaffed energy offices with limited legal authority.

Although tendering systems, such as Non-Fossil Fuel Obligations, require less institutional capacity, in a country like the Maldives, with a few domestic RET manufacturers or developers, only a small number of companies might respond to bidding rounds, which would limit both choice and competition. And since smaller projects are often unable to compete with larger ones on the basis of costs alone, participation can easily be limited to large players and result in serving primarily the interests of major suppliers or utilities. In the Maldives, this would concentrate renewable energy development in the hands of the State Electric Company, leaving local Island Development Committees and small private parties unable to compete. Furthermore, bidding processes tend to be bureaucratic, they have significant transaction costs, and they are time-consuming for authorities and project developers [54]. All of these factors make tendering systems, just like obligation certificates, particularly unsuitable for the Maldives.

5.2. Pricing systems

Unlike quota systems, pricing laws seem more suitable for the Maldives, where power markets are small and dispersed. Pricing systems favor smaller companies (even individuals or co-operatives) and incremental investments, leading to varying sizes of companies and projects [35]. Upon putting this forward to the stakeholders, all encouraged establishing regulations that enable net metering for PV systems on the more densely populated islands.[8] Supporting this initiative, the government should install RETs for net metering on public buildings, e.g., schools and hospitals. On the other hand, net metering through PV systems was not considered a viable option for the outer islands, as the current generators already run at low loads during day time and excess electricity produced from direct solar energy would further diminish this level of efficiency.[8] On the outer islands, communities should be encouraged to invest in small renewable–diesel hybrid systems, to reduce the dependence on diesel and to utilize renewable resources as much as possible. As suggested above, the local power distributors on the outer islands should purchase the electricity generated from these hybrid systems.

On the downside, pricing laws were criticized by various stakeholders for being inflexible and expensive. For example, once tariffs have been established, they are difficult to reduce. However, representatives of the government argued that it is possible to set up the system

(*footnote continued*)
agreed to a target below 3%. This raises concerns about the country's GEF funded RETDAP commitment to achieve 12% power generation through renewable energy by the year 2010.

[8]This is of benefit to the utility as well as the system owners, since excess power generated during peak hours can improve load factors and offset the need for new peak load generating capacity, especially in Malé, due to the high energy demand for air conditioning, during office hours. This is in contrast to the majority of the outer islands, where the peak load is demanded in the evening (due to lighting), which makes it impossible to use direct solar energy in order to meet this peak demand. On the other hand, the peak load could be partly met by a battery bank, to be charged in daytime by PV panels [7].

in such a way that payments can be adjusted on a regular basis to reflect changes in technologies and market conditions. Thus, once a government has set the price to be paid for renewable electricity, it can be adjusted in the future, either up or down as desired, to regulate the amount of new capacity connected to the grid. Regular adjustments of tariffs are the only government follow-up required.

5.3. Capital investment rebates and production subsidies

In order to enforce the regulations that govern market access, financial incentives could be launched. In the review of possible incentives, a distinction was made between subsidies on capital investment and production subsidies. According to most stakeholders, production subsidies are particularly suitable to support the pricing system proposed above. In this way, the administration and enforcement costs of pricing laws do not have to be financed entirely by a levy on electricity that is borne by the utility or passed on to the costumers.

However, with regard to the Maldives and most SIDS, where the installation and initial investment costs of RET projects create one of the greatest barriers to the actual implementation, investment subsidies appear to be a more suitable option. On a national level, rebates for RETs can be offered as part of a project development subsidy, available from e.g. the Ministry of Atoll Development for the outer island communities. Representatives of the government and financial organizations stressed that all investment subsidies should be accompanied by technology standards and monitoring programs, in order to ensure good performance and to prevent inferior technologies from entering the market. Furthermore, it is important to enact rebates that are flexible (i.e. that can be adjusted up or down as necessary) and that have a defined phase-out time frame in case technology costs fall or if other support mechanisms take their place. This will ensure efficiency improvements in RETs and avoid the sudden decline in investments that often occur when subsidies expire [17]. Bearing in mind the limited financial capacity in the Maldives, one way of financing these rebates is to seek capital investment support through grants from bilateral aid.

5.4. Financing assistance

Besides rebates, financing assistance in the form of low-interest and long-term loans can play an important role in overcoming the barrier of high initial capital. Currently, the available financial assistance for energy projects is focused on the purchase of portable diesel power generator sets. However, the Maldives' experience with revolving funds provides the basis on which similar financing can be established or extended to RET loans. A renewable energy project financing scheme suggested by RETDAP, 'the Fund for Renewable Energy System Applications' for the outer islands, aims at developing funds in the Ministry of Atoll Development's credit facility sub-account for lending to RET projects [5]. The terms and conditions of this fund have not been established yet. According to the supply-side stakeholders, the terms and conditions of loans provided for RETs should be similar to those offered for outer island conventional electrification projects. Moreover, it was emphasized that the higher capital costs and longer payback period for RETs should be taken into consideration when establishing these funds.

Furthermore, the NGOs stressed that such a financing scheme should not discriminate against private parties.

5.5. Tax incentives

With regards to the suggested use of tax incentives for the Maldives that could be used to internalize the beneficial externalities of RETs, the stakeholders made clear that the best option would be to reduce the import duty concessions for RET equipment. As import duties increase the upfront costs of renewable energy projects, they should be significantly reduced if not eliminated, at least until a strong domestic manufacturing industry has been established. Stakeholders agreed that renewable energy project developers should be offered either duty-free concessions (also available for resort developers) or import duties similar to those of diesel generators.

On the other hand, the majority of the stakeholders opposed to the idea to introduce a carbon tax on diesel-based electricity production, while providing carbon tax exemptions for electricity produced from RETs. The opposition arose from the concern that the costs would be passed on to the customer. This could have large economic consequences on the outer islands, where the electricity costs are already a burden to the local communities. Bearing this in mind, it may be possible to adopt a system similar to the categorized tariff scheme already in place in Malé, ensuring that the carbon taxes are directed to the energy intensive industry and that they do not affect the poor. However, the implications of such an arrangement for different sectors of the economy (e.g. fishing and transport) and for the economic development of the country as a whole, would need to be considered carefully.

5.6. Addressing subsidies for conventional energy

Stakeholders considered financial and tax incentives, although necessary to promote RETs, inadequate in themselves to give RETs the foothold they require. Some argued that 'subsidies on conventional electricity need to be stopped'. They agreed that all direct and indirect subsidies for conventional energy should be identified and gradually eliminated or shifted towards RETs. It was understood that even a small shift in these expenditures could have a tremendous impact on the renewable energy market in the Maldives. Ideally, this transition would mean transferring money flows from conventional energy to renewables, without the need to search for new financial means to invest in renewable energy. However, once again, the stakeholders stressed their wish to ensure that the removal of subsidies would not negatively affect the poor. Instead, subsidies should enable the local communities to make use of renewable energy alternatives.

5.7. Public–private partnership and stakeholder involvement

In order to increase the chances of success of a policy framework that fosters the widespread implementation and, ultimately, commercialization of RETs in the Maldives, the stakeholders agreed that institutions facilitating this process need to be established. Public–private partnerships are considered a suitable way to deliver this public infrastructure and related services, providing essential input and guidance for the development and implementation of action plans. Therefore, government support needs to focus on the establishment of this kind of partnership, rather than on individual projects,

especially since project-specific funding tends to create cycles of sudden increase and collapse of RETs and fails to build institutional capacity.

A first attempt to establish institutions that could support the utilization of RETs in the Maldives has resulted in the draft of a corporate law enabling Island Development Committees and private parties, interested in setting up their own utility services, to form 'island co-operatives'. These co-operatives will be legal entities able to receive long-term licenses from the Maldives Electric Bureau, hence giving them a chance to compete more equally matched with the State Electric Company. Moreover, some stakeholders suggested the establishment of 'Atoll Utility Companies', coordinating between relevant parties and enabling islands in each atoll to take advantage of efficient management and access to financial capital.

It is suggested that these Atoll Utility Companies provide RET parts and services, including training and frequent visits from trained maintenance personnel. Considering the size of the country and the limited qualified manpower, a lean structure of these agencies seems more appropriate, implicating the importance of their co-ordinating role.

6. Conclusions and policy implications

Assessing the wider implications of this study, it is believed that the evaluation of policy measures addressing the current barriers to the realization of a domestic market for RETs, is largely applicable to SIDS worldwide, as most SIDS have a similar combination of socio-economic and environmental characteristics. The interactions of these island-specific attributes make RETs particularly suitable for electricity generation, e.g., the abundance of renewable energy resources and the heavy dependence on expensive fossil fuel imports. On the other hand, factors such as the limited institutional and financial capacity of SIDS, generate market and financial barriers for RETs that differ considerably from those faced by larger land-locked developing countries.

Evaluating various policy options for this particular context, it was found that pricing laws regulating market access are, at present, more suitable than policy schemes based on tradable renewable energy credits or tendering systems, combined with government mandated quotas. In addition to being more cost effective and relatively more self-regulating, pricing laws favor a varying size of projects and are more suitable for the dispersed markets of SIDS. Production subsidies are particularly suitable to support such a pricing system. These subsidies could prevent the additional costs for renewable electricity generation from being passed onto the costumer. This should be avoided at all times, especially on the outer islands where the high electricity prices are already a burden for the local communities.

As for the other financial incentives that can be made available for RETs, rebates on investments tied to technology standards should be deployed to address the barrier of high investment costs of RETs. Besides these investment subsidies, financing assistance in the form of low-interest and long-term loans can play an important role in overcoming the barrier of high initial capital. These loans and subsidy schemes should be partly provided through bilateral aid, as the financial capacity in most SIDS is limited.

However, it was realized by most stakeholders in the Maldivian energy sector that financial and tax incentives, although necessary to promote RETs, are not adequate in and of themselves to give RETs a substantial market share. They agreed that most direct and indirect subsidies for conventional energy should be identified and gradually eliminated or

shifted towards RETs, with the guarantee that the removal of subsidies will not negatively affect the poor.

In addition to this, the importance of adopting policies to meet regional needs becomes apparent. The situation of institutional barriers, presently the primary reason as to why RETs have not penetrated the electricity market in the Maldives, suggests that support should focus on enabling the development of regional institutions rather than on enabling individual RET projects. These institutions should enable islands in each atoll to take advantage of efficient management and to grant potential renewable electricity providers access to financing. This will allow the development of sustained RET projects which, in turn, will result in increased renewable capacity and decreased costs.

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